2. THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

The BLM identified a range of alternatives to the Proposed Action based on issues, concerns, and opportunities raised in public comments during scoping; interdisciplinary interaction between resource professionals; and collaboration with cooperating and other interested agencies. Comments on the Proposed Action received during the public scoping period are summarized in **Section 1.9, Public Participation**. A more detailed description of the public comments is found in **Appendix A: Summary of Scoping Comments by Category**. The alternatives to the Proposed Action that are examined in detail in this Draft EIS include Alternative A: 100-Percent Vertical Drilling; Alternative B: Enhanced Resource Protection; Alternative C: Surface Disturbance Cap—High and Low Density Development Areas; Alternative D: Directional Drilling; and Alternative E: No Action. The Proposed Action and the alternatives are described in this chapter. The BLM NEPA Handbook (H-1790-1) calls for expression of the BLM's preferred alternative in the Draft EIS if one exists (BLM 2008c). The BLM does not have a preferred alternative for the CD-C Natural Gas Development Project at this time. The BLM believes that the Proposed Action and the action alternatives all have elements that would address the project purpose and need and will review public comment on the Draft EIS before determining a preferred alternative. A preferred alternative will be designated in the Final EIS.

Although the development activities anticipated in the Proposed Action and in the alternatives would take place on federal, state, and private lands, BLM authority applies only to the activities that would occur on BLM-administered lands. Those activities on BLM-administered lands and mineral estate for the Continental Divide-Creston (CD-C) Natural Gas Development Project must conform to the Rawlins RMP. The Rawlins RMP was completed in December 2008 (BLM 2008a) and is available at <http://www.blm.gov/rmp/wy/rawlins/documents.html>.

2.2 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.2.1 The Proposed Action

BP America Production Company and other operators (the Operators) propose to drill up to 8,950 wells on approximately 1.1 million acres of federal, private, and state mineral estate (**Map 1-1**). These wells would be in addition to the more than 4,400 wells that have already been drilled in the CD-C project area. Up to 500 of the proposed wells could be coalbed natural gas (CBNG) wells. The project, as defined by the Operators, is summarized here. For more detailed information, please see the Operators' detailed Plan of Development in **Appendix B**.

The proposed natural gas wells could be drilled either conventionally (with a single vertical well bore on each well pad) or with multiple directional well bores from a single pad. It is anticipated that all wells would be drilled during the 10- to 15-year period after project approval. Although actual operations are subject to change as conditions warrant, the Operators' long-term plan of development is to drill at the average rate of approximately 600 wells per year until the resource is fully developed. The Operators anticipate drilling infill wells at potentially up to 40 acres per down-hole well bore. Based on existing reservoir and well performance information, most gas wells will be completed in the Almond Formation (Mesa Verde Group), although secondary reserves may be encountered in other formations (e.g. Lewis, etc.). The average life of a well is expected to be 30 to 40 years. Combining well life with a 15-year production period produces a potential project life of 45 to 55 years. Factors outside of the Operators' control, including geologic characteristics, reservoir quality, engineering technology, and economic conditions could affect the Operators' ability to adequately drain the reservoir and could result in fewer than 8,950 wells being drilled.

The facilities required by the project would include: roads; gas, water, and condensate gathering pipelines; overhead and buried power lines; production facilities (separation, metering, treating, fluid storage, compression, artificial lift, etc.); disposal well and/or surface disposal facilities; equipment storage facilities; and other associated facilities. In general, gas would be transported via subsurface pipelines to centralized compression and treatment facilities, although some well-site compression may be included on an as-needed basis. Produced water would be transported by truck to water-disposal wells or evaporation ponds, or by pipeline to treatment facilities. Existing arterial roads would provide the main access to and within the project area.

2.2.1.1 Construction Activities

Since much of the project would largely be an infill development in an existing natural gas field, new road construction would not be extensive. The primary access to the project area is Interstate 80 (I-80). Existing arterial roads, including Wyoming State Highway (WY) 789 and several Sweetwater and Carbon county roads, provide access within the project area. New road construction would primarily be short sections of road from the existing road network to new well sites and support facilities. Some existing access roads may need to be improved to accommodate increased traffic. Specific locations for access roads are not known at this time but will be included in permit applications and will be evaluated by the BLM during onsite inspections.

The project would include the construction of 8,950 well bores from both single-well pads and well pads with multiple directional well bores. Construction of a typical single-well pad would require approximately 6.3 acres, which includes 0.9 acres for an access road. A typical multiple-well pad would disturb approximately 2.45 acres per well bore, which includes 0.45 acre for an access road. Operators will determine the locations of new wells according to the subsurface reservoir, the topography of the area, and Wyoming Oil and Gas Conservation Commission (WOGCC) spacing rules. Dimensions of drill pads will depend on topography and specific well needs.

Table 2.4-1 shows the estimated surface disturbance for the Proposed Action and the alternatives to the Proposed Action.

2.2.1.2 Drilling and Completion

Well-drilling and completion activities will be in compliance with Federal Onshore Oil and Gas Order No. 2. These guidelines specify the following:

> *…proposed casing and cementing programs shall be conducted as approved to protect or isolate all usable water zones, potentially productive zones, lost-circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.*

The Operators anticipate that the drilling-rig count within the project area would be up to 25 rigs at any particular time in order to achieve development objectives. Wells would be drilled utilizing conventional, mechanically powered mobile drilling rigs. Drilling each gas well would take from 7 to 20 days, with additional time likely for directional wells and wells deeper than 10,000 feet. The Operators propose to drill year-round subject to environmental considerations.

Approximately 20,000 to 30,000 barrels (bbls) of water are needed to perform drilling operations for each well. Fresh water would be used for drilling the first 5,000–7,000 feet of each gas well, and water-based muds would be used for the remainder of the drilling operation. Water would come from existing and new water-supply wells within the project area, as well as from produced-water sources. The use of produced water to the greatest extent possible would conserve fresh-water aquifers. No water would be withdrawn from surface waters of the project area.

A fenced reserve pit, approximately 10 to 12 feet deep, would be excavated within the pad to temporarily store drilling fluids and cuttings. The reserve pit would be lined if so specified in the APD; in non-environmentally sensitive areas and when a fresh water-based drilling mud is used, the reserve pit may be unlined pending evaluation of the distance to surface water, depth to useable ground water, soil type and permeability, and anticipated types of fluids that would be contained in the pit. Reserve pits would be constructed so as minimize the potential to leak, break, or allow discharge and in accordance with APD Conditions of Approval (COAs). The reserve pit would be fenced on three sides during drilling operations and on the fourth side when the rig moves off the location. On producing wells, the reserve pit would be reclaimed per the requirements specified in the approved APD. Reserve pits may be re-used for multiple wells being drilled from a single pad. Although not specified in the Operators' Plan of Development, the use of closed-loop drilling systems that allow for reuse of drilling fluid and remove the need for a reserve pit may be implemented.

Drilling operations require approximately 8 to 10 personnel and six vehicles on location at any given time each day during normal operations. An additional 10 to 15 personnel and six vehicles would be required on location during the running and cementing of production casing. A cementing plan is submitted with the drilling plan as part of the Application for Permit to Drill (APD). This plan is reviewed by the BLM and/or the WOGCC.

When production casing has been cemented in place, completion operations would begin. In general, completion consists of perforating the production casing, pressure testing, stimulation of the formation utilizing hydraulic fracturing technology, flow-back of fracturing fluids, flow testing to determine post-fracture productivity, and installation of production equipment to facilitate hydrocarbon sales.

Hydraulic fracture stimulation is required on the majority of wells in the project area during completion operations in order to enhance productivity. Combinations of fluids and proppants are pumped down the well bore through the perforations in the casing, and into the formation to optimize stimulation. One common stimulation technique utilizes gelled fresh water (with CO_2 and/or N_2 frequently added for reservoir protection and enhanced flowback) and fracture proppants to provide bridging and increased permeability. Sand, resin-coated sand, ceramics, or bauxite can be used as proppants. Gels and other chemical additives provide fluid viscosity. Sufficient rate and pressure are reached to induce a fracture in the target formation. The proppant carried in the fluid serves as a bridge to keep the created fracture open and to provide a flow path that allows reservoir fluids to move more readily into the well bore. Water used for stimulation purposes generally comes from water supply wells. Stimulation fluids recovered during flow back and subsequent production operations are temporarily contained in the completion, flare, or reserve pit. As discussed under **Drilling Operations** in **Section 4.4.4.1**, the hydraulic fracturing process is currently being regulated or is being evaluated by the EPA, the BLM, and the WOGCC.

In May of 2012, the BLM proposed a new rule under 43 CFR Part 3160 (BLM 2012a) to regulate hydraulic fracturing on public and Indian lands. The rule would (1) provide disclosure to the public of chemicals used in hydraulic fracturing on these lands, (2) strengthen regulations related to well bore integrity, and (3) address management and storage of flowback water. In April of 2012, the EPA issued final rules that include the first federal air quality standards for natural gas wells that are hydraulically fractured, along with requirements for several other sources of pollution in the oil and gas industry (EPA 2012a).

Completion and testing operations typically require approximately 10 to 20 (up to 30) days to perform, 2 to 30 personnel, and 1 to 20 vehicles on location. Approximately 4,000–12,000 bbls of water per well would be needed for completion and testing operations. Drilling and completion activities together would require 24,000-42,000 bbls of water per well.

2.2.1.3 Production Facilities

Production facilities on the well pad would typically include wellhead valves and piping, separation, dehydration, metering equipment, oil and water production tanks, a methanol storage tank and pump, and telemetry equipment. Production equipment would be fueled by natural gas or electricity. Telemetry equipment is currently used or planned for use by most Operators to improve well evaluation and operational efficiency, and to minimize well visits. Production pits would not be used. Well-site compression could be utilized on an as-needed basis. Buried natural gas gathering lines would be installed to transport produced gas from new wells to the existing gas-gathering pipeline system. The Operators would continue to use existing natural gas transmission pipelines that serve the project area. New natural gas transmission pipelines are not included as a component of the proposed project.

The project may also include the development of an overhead electrical system to provide commercial power to portions of the field, as well as lower-voltage, buried power utilities to individual well pads. The overhead system is estimated to include approximately 36 miles of line.

2.2.1.4 Pipelines

The Operators would use existing natural gas transmission lines that serve the project area. Operators are not responsible for the construction or operation of gas transmission lines, and new transmission lines are not included as a component of the CD-C project.

Gathering lines would be installed below the surface to transport the produced gas from the new wells to the gas gathering pipeline system. The gas production lines would be located adjacent and parallel to well access roads where possible to minimize surface disturbance. New pipelines would cross federal, state, and private surfaces in a route developed to minimize both resource conflicts and development costs.

Pipeline construction consists of trenching, pipe stringing, bending, welding, coating, lowering pipeline sections into the trench, and backfilling. In general, construction widths would be 50 to 75 feet when not adjacent to a road and 25 to 50 feet when adjacent to an existing or new road. Newly constructed pipelines would be hydrostatically tested to ensure structural integrity. As an example of water requirements, approximately 2,700 gallons of water would be required to test one mile of four-inch pipeline. Hydrostatic test water would be disposed of as approved by the BLM and/or the State.

2.2.1.5 Compression, Gas Treatment, and Ancillary Facilities

Because the existing compression infrastructure in the project area would not provide sufficient capacity to compress the additional gas volumes anticipated from the CD-C project, supplemental compression would be required at various locations throughout the project area. An estimated 24,936 horsepower (hp) of additional compression may be needed as the project is developed for dedicated compressor sites and at well sites. The additional compressor sites, including a large central pipeline compression facility and possibly some well-site compression, could add up to 60 acres of disturbance.

It is anticipated that one additional central gas-processing/stabilization facilities would be needed within the project area, affecting up to 30 acres.

2.2.1.6 Produced-Water Disposal

Produced water from conventional natural gas production may be stored in tanks at the well site prior to transport by water-hauling trucks or transported in flowlines to collection facilities for disposal. All produced water disposal would be in accordance with applicable WOGCC and WDEQ requirements and approved under BLM Sundry Notice, as appropriate. An estimated 30 new injection wells and 20 produced water handling facilities would be constructed to dispose of produced water. The Operators have no plans for surface discharge of produced water. Conventional wells in the project area average 18 bbls/day of produced water. Produced water, condensate, and gas would be separated at the well site or at

central facilities. Depending on the method of disposal, permits are required from WDEQ-WQD (surface) or WOGCC (subsurface) for disposal of produced water.

This document does not analyze the disposal of produced water from CBNG development. The volume of water produced in CBNG development is typically and initially much greater than for conventional gas production. CBNG-produced water might be stored onsite in a lined pit or storage tank, or water-collection lines might be installed to transport water to a water-treatment facility, evaporation ponds, injection wells, subsurface drip areas and/or approved discharge points. The actual volumes produced and the methods by which the produced-water would be managed are greatly dependent on the site-specific development proposals, and it would be speculative for the BLM to analyze this aspect of CBNG development in detail in this EIS. For that reason, this document does not contain any description of produced-water disposal for CBNG development and does not analyze the impacts of such development. When the BLM receives site-specific CBNG proposals in the CD-C project area, those proposals, including their produced water treatment, will be analyzed in a future NEPA document.

Interim reclamation on well pads and roads would begin as soon as possible after the well is put into production. The reserve pit, that portion of the well location and access road not needed for production operations, and pipeline corridors would be reclaimed according to the requirements specified in the approved APDs. Well pads and roads would be reclaimed and reseeded back to the minimum size required.

When production at a well site is completed, the Operators would cut off the casing three feet below the final graded ground level and cap it. All surface equipment would be removed from the site and the surface would be recontoured to its original appearance, to the extent possible. Topsoil would be distributed over the location to blend the site in with its natural surroundings. All surface disturbance would then be planted with an appropriate seed mixture. Reclaimed sites would be monitored to ensure erosion is prevented and/or controlled and the desired plant species are being re-established. Monitoring would continue until the reclamation is deemed successful.

2.2.1.7 Operator-Committed Practices

Plan of Development. The Operators' Plan of Development indicates that they would adhere to all lease and APD conditions, as well as all federal and state laws, regulations, and policies implemented through statute and/or resource management planning decisions implemented through NEPA. The Operators specifically cite BLM Instruction Memorandum No. 2004-194, *Integration of Best Management Practices into Application for Permit to Drill Approvals and Associated Rights-of-Way,* and note that Best Management Practices (BMPs) to be considered in nearly all circumstances include the following:

- Interim reclamation of well locations and access roads soon after the well is put into production;
- Painting of all new facilities a color which best allows the facility to blend with the background, typically a vegetated background;
- Design and construction of all new roads to a safe and appropriate standard, "no higher than necessary" to accommodate their intended use; and
- Final reclamation recontouring of all disturbed areas, including access roads, to the original contour or a contour that blends with the surrounding topography.
- The Operators commit to performing these environmental protection measures during the implementation of their proposed project. **Appendix C** includes a summary description of the BMPs and APD COAs typically used by the BLM in the Rawlins Field Office to implement the federal laws, regulations, and policy aimed at mitigating environmental impacts.

Air Quality. During preliminary near-field air dispersion modeling analyses of CD-C project emissions it was apparent that the nitrogen dioxide ($NO_{2)}$ concentration impacts were above the 1-hour NO_2 National Ambient Air Quality Standards (NAAQS) for modeling scenarios that included drill rig

engines with Tier 0 emissions levels, and it was necessary to consider drill rig engines with at least Tier 2 emissions levels in order to demonstrate compliance with the 1-hour NO_2 NAAQS. Therefore the CD-C Operators committed to using a minimum of Tier 2 drill rig engines for drilling operations. This commitment will be included and become enforceable in the Record of Decision.

2.2.2 Alternative A: 100-Percent Vertical Drilling

Although not stated explicitly, the Operators' Proposed Action assumes a substantial amount of directional drilling. Approximately 42 percent of the 8,950 wells to be drilled would be located on multiple-well pads and drilled to the target formation directionally; the other 58 percent would be located on single-well pads and drilled vertically. The estimated surface disturbance that would result from the Proposed Action would be reduced because of the directional drilling. However, the proposal contains no commitment on the part of individual Operators or the group as a whole to implement that amount of directional drilling. The directional drilling included in the proposal is tied to the current plans of individual Operators and could change as Operators, leaseholders, or conditions change.

In order to examine the possibility that all 8,950 wells would be drilled from single-well pads, the BLM developed Alternative A, with 100-percent vertical drilling. All other elements of the CD-C project would remain as described in the Proposed Action. With the assumption of 100-percent vertical drilling, the estimated surface disturbance is increased by 31 percent, from a project total of 47,200 acres to 61,696 acres.

Table 2.4-1 shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.

2.2.3 Alternative B: Enhanced Resource Protection

Environmental protection and mitigation of environmental impacts are important aspects of the BLM's management of natural gas development on public lands. The RFO has a suite of basic protections that are used to minimize the effects on resources. Restrictions and limitations called for by the Approved Rawlins Resource Management Plan (RMP) are imposed prior to development activities. Additionally, a number of standard operating procedures and Best Management Practices are implemented as needed. These are described below and throughout the description of Alternative B as ***Basic Protections***. The premise of the Enhanced Resource Protection Alternative is that intensive natural gas development may increase the risk of adverse impact for some resources and thus those resources may require protections and mitigation beyond the Basic Protections. This alternative identifies the resources that may be more at risk from natural gas development and the ***Enhanced Resource Protections*** that would be implemented for these resources, which include enhanced protections and mitigation.

The alternative also recognizes that future development may be more intensive than currently expected or may have unintended consequences, resulting in impacts on wildlife habitats and populations in areas that were not anticipated or impacts that occur at a faster pace than anticipated. For that reason, the alternative describes disturbance and population thresholds that, if crossed, would signal the need for still more protections and mitigation. The thresholds are described below and throughout the alternative description as ***Surface Disturbance Thresholds*** and ***Population Thresholds***.

The resources that would receive enhanced protection under this alternative are:

- Mule deer crucial winter/yearlong range and migration corridors;
- Pronghorn antelope crucial winter/yearlong range and migration corridors;
- Greater sage-grouse lek, nesting/brood-rearing habitat, and winter concentration areas;
- Ferruginous hawk nesting habitat;
- The Muddy Creek and Bitter Creek corridors and watersheds;

- Chain Lakes alkaline wetland communities and other playas; and
- Livestock grazing.

Basic Protections

Most of the above resources already have protective measures specified in the RMP or applied as standard operating procedures. Such measures would apply to oil and gas operations within the CD-C project area under all alternatives. These Basic Protections are described below in each section for the resources receiving enhanced protections as a reminder that these requirements apply at all times regardless of alternative. For example, no activity is permitted within 0.25 mile of the perimeter of an occupied sage-grouse lek year-round. During the sage-grouse nesting/early brood-rearing season, March 1 – July 15, no activity is permitted within all identified sage-grouse habitat. Other RMP measures are provided in detailed guidelines for resource management such as those found in RMP Appendix 11 – Water Quality and Watershed Management.

Standard operating procedures for resource protection can be found in Conditions of Approval (COAs) placed on an APD or in terms and conditions placed on a right-of-way grant (see **Appendix C**). In addition to items aimed at minimizing soil and water erosion and promoting successful reclamation, those measures may include such things as pre-disturbance surveys, consultation on facility location, signage, and constraints on traffic.

Recently, interim conservation measures for sage-grouse have been proposed by Wyoming BLM Instruction Memorandum (IM) WY-2012-019 (February 10, 2012), which provides new statewide measures for protection of greater sage-grouse habitat. The IM provides interim program direction consistent with Washington Office IM No. 2012-043 until BLM Wyoming's effort to evaluate effective greater sage-grouse conservation measures through amendment of RMPs is completed. The protective measures identified in the IMs referenced above, or their functional equivalents, were analyzed within the range of alternatives.

Enhanced Resource Protections

Alternative B builds on the basic protections that are currently in effect in the project area, expanding the scale of some measures or adding new measures. An example of an expanded measure is increasing the avoidance zone around the Chain Lakes wetlands and other playas from 500 feet to 0.25 mile. Examples of new measures are burying new power lines within 1 mile of an occupied lek or in winter concentration areas, and extending the current monitoring program in Upper Muddy Creek to Lower Muddy Creek.

Specific expanded resource protections are described for each of the high-value resources but several general protections apply to all. Three of these are:

1. Uniform application of dust-abatement procedures during construction and drilling operations year-round and seasonally, as needed, on well sites, pipelines, and collector and well access roads.
2. Environmental awareness training during orientation for all employees and subcontractors, including information about native wildlife, sensitivity to various kinds of impacts, Wyoming wildlife laws, etc.
3. BLM will require remote monitoring at well pads when a surface disturbance threshold of 5 percent is reached for the resources that have that threshold.

In addition, Applications for Permit to Drill (APDs) that would affect any of the described resources except livestock forage would be submitted with an overall development plan. The development plan would be submitted either for an individual lease or several leases. It should aim at reducing surface disturbance and disturbance associated with vehicle traffic and other human activity and should include, at a minimum:

- Consideration of cluster development of production facilities;

- A road system that minimizes construction of new roads;
- Individual road design that minimizes surface disturbance while still meeting safe standards for the intended use;
- Reconstruction of access roads to a lower standard once drilling is completed and the operation phase has begun;
- Reclaiming of all but one road once production starts if more than one road is built within the lease;
- A travel plan that minimizes vehicular traffic for monitoring and servicing wells and other facilities and that includes closures and/or time-of-day restrictions for production roads during the winter season;
- Consideration of pipelines for transporting liquids offsite or installation of larger-capacity storage tanks to reduce the number of truck trips to well sites; and
- A snow-removal plan to ensure protection of resources.

Plans for development within the entire Muddy Creek and Bitter Creek watersheds should include, at a minimum, the following additional road/pipeline requirements:

- Detailed development, transportation, and reclamation plans, including road design, culvert placement, steep slopes, etc.;
- Design of improvements to existing roads or construction of new roads to minimize hydrologic alteration;
- No new road crossings of Muddy Creek;
- Development of specific road design criteria based upon site-specific review and likely including a combination of mitigation options; and
- Submission of data from inspections of erosion control BMP's within the Muddy Creek and Bitter Creek watersheds would be required. The format and frequency of submission of these data would be coordinated with the BLM and could use the same information collected under the Stormwater Pollution Prevention Plan (SWPPP) or other BLM-approved monitoring method.

Surface Disturbance Thresholds

There may be instances in the future where natural gas development is even more intense locally than currently anticipated or where the overall impacts are greater than expected. In such cases, the Enhanced Resource Protection Alternative includes surface disturbance thresholds for five of the seven high-value resources: mule deer crucial winter/yearlong range and migration corridors; pronghorn antelope crucial winter/yearlong range and migration corridors; greater sage-grouse lek, nesting/brood-rearing habitat, and winter concentration areas; ferruginous hawk nests; and livestock grazing.

Generally, two threshold levels are specified:[3]

- A lower level, usually 5 percent of protected habitat within a lease and/or right-of-way, that signals a potential problem and mandates an evaluation of reclamation success. If reclamation success is limited, a revised plan would be required to address the failings. The initial level also calls for an assessment of the disturbance to determine if mitigation is needed. If it is, APDs will not be processed or approved until the BLM has received and approved a mitigation plan that will effectively mitigate the impact to the affected resource.

[3] The 5% and 10% thresholds rely on WGFD guidance on mitigating oil and gas development and its references to High and Extreme impacts on habitat. High is generally referred to as 20-60 acres of disturbance within a section, and 5% is a proxy for that (640 acres X .05 = 32 acres); Extreme is 60 acres or more per section and 10% is a proxy for that (640 acres X .10 = 64 acres). Percentages have more utility than absolute figures when areas less than or larger than a section are under discussion.

- A higher threshold level, usually 10 percent of protected habitat within a lease, would require habitat improvement projects in addition to the above requirements.

Disturbance that is counted against the threshold includes all disturbance, both current and pre-existing, that is associated with natural gas access roads, pipelines, well pads, or other facilities that serve the Operator's lease and off-lease rights-of-way on adjacent BLM lands that also service the lease. Rights-of-way that cross a lease but service other Operators' leases would not count in the percentage calculation. The details of the surface disturbance thresholds for each of the five resources are described in the sections below.

Population Thresholds

Additionally, there are population thresholds for four resources: mule deer crucial winter/yearlong range and migration corridors; pronghorn antelope crucial winter/yearlong range and migration corridors; greater sage-grouse lek, nesting/brood-rearing habitat, and winter concentration areas; and ferruginous hawk nests and potential nesting substrate. If the Wyoming Game and Fish Department (WGFD) were to express formal written concern that a species population within the project area were declining at an accelerated rate compared to the rest of the population, a technical team would be assembled to prepare a mitigation plan as described above. APDs would not be processed or approved until the BLM has received and approved a mitigation plan that will effectively mitigate the impact to the affected resource. The plan would include, but not be limited to:

- Evaluation of reclamation success and a request that the Operator provide a revised reclamation plan to address any failed reclamation.
- Implementation of BLM-approved habitat-improvement projects such as water developments or vegetation treatments. (The BLM may coordinate habitat improvement projects among multiple Operators.) New well pads would not be authorized without Operator participation in habitat-improvement projects.
- Limitation of the number of well pads per section to maintain habitat effectiveness.

The preferred mitigation would be site-specific. If a species status were to change in the future, additional data, especially seasonal habitat use and condition data, would be collected and additional protective measures would be developed.

2.2.3.1 Pronghorn Antelope and Mule Deer

Area of Concern: Pronghorn Antelope Crucial Winter Range/Yearlong Range (referred to as "CWR" in the description of this alternative) and Migration Corridors (**Map 3.8-2**) and Mule Deer Crucial Winter and Crucial Winter/Yearlong Range (also referred to as "CWR") and Migration Corridors (**Map 3.8-4**).

Basic Protections:

RMP Requirements

- Seasonal restrictions on construction, drilling, and other activities from November 15 – April 30.
- Disruptive activities within big game crucial winter range would require the use of BMPs designed to reduce the amount of human presence and activity during the winter months (Appendix 15 of the ROD).
- Surface-disturbing and disruptive activities would be managed on a case-by-case basis in identified big game migration and transitional ranges to maintain their integrity and function.
- Fences identified to be a problem for big game migration would be modified to meet BLM fence standards. New fences would be allowed in big game migration corridors, provided they meet BLM fence standards.

- Standard site-specific requirements
- Appendix 15 of the RMP includes other BMPs that can be considered to reduce impacts from gas development, some of which are included as requirements in this alternative (e.g., remote well monitoring).

Enhanced Resource Protections:

- Applications for Permit to Drill (APDs) within mule deer or pronghorn antelope crucial winter or crucial winter/yearlong range and migration corridors would be submitted as part of an overall development plan for an entire lease or several leases. The plan is described above under the general requirements for the alternative.

In addition, the following requirements would be implemented throughout mule deer and pronghorn antelope crucial winter range or crucial winter/yearlong range and migration corridors:

- Man camps would be prohibited on BLM land;
- Noise-reduction technology, such as hospital grade mufflers, sound walls or soundproof buildings, or adding silencers to cooling fans, would be required at compressor stations; and
- Migration corridors would be monitored to determine which fences restrict movement and fences modified to reduce impacts to migrating big game species.

Surface Disturbance Thresholds:

When surface disturbance for natural gas access roads, pipelines, well pads or other facilities exceeds 5 percent of pronghorn antelope or mule deer CWR and migration corridors within a lease, BLM would:

- Evaluate reclamation success in the lease and review, approve and oversee the implementation of an Operators' revised reclamation plan to ensure it addresses the reason for the failed reclamation. The calculated percentage disturbance would be adjusted downward for successful interim reclamation.
- Conduct an assessment of the disturbance and determine if enhancement of CWR is needed at this time. If so, begin implementation.
- Require installation of remote monitoring at all well pads.

If surface disturbance reached 10 percent of pronghorn or mule deer CWR and migration corridors in a lease, habitat improvement projects would be required in addition to the requirements above. The BLM would establish an interagency CD-C working group and consult with them to determine which projects would be beneficial. These projects could include, but would not be limited to:

- Water developments.
- Vegetation treatments such as herbicide treatments, seeding, prescribed burning, cutting/chopping for regeneration, planting shrubs or trees, fencing, establishing food plots, etc.

Population Thresholds:

Mule deer and pronghorn antelope in the project area are managed by the WGFD on a Herd Unit basis. Three mule deer Herd Units overlap the project area (**Map 3.8-3**). The resource of concern in this alternative for mule deer is CWR and migration corridors which only occur in the project area within the Baggs Herd Unit (**Map 3.8-3**). In 2010, the Baggs herd population was estimated at 22,000 animals, which is well above the WGFD population objective of 18,700 (**Table 3.8-1**). The project area includes less than 25 percent of the total Baggs Herd Unit acreage and only 6.3 percent of the crucial winter range and crucial winter/yearlong range.

For pronghorn, there are also three Herd Units that overlap the project area (**Map 3.8-1**). The Baggs and Red Desert Herd Units each contain a portion of pronghorn CWR. Migration corridors are found in all three units. The Red Desert Herd Unit's CWR lies north of I-80 along the majority of its route across the project area. The CWR for the Baggs and Bitter Creek Herd Units is adjacent to WY 789 in the southeastern portion of the project area (**Map 3.8-1**), overlapping the majority of the mule deer CWR.

Aerial surveys of the three Herd Units are done on a rotating basis, typically every two to three years. All three of the Herd Units are much larger than the portion within the project area; 26 percent of the Red Desert Herd Unit, 23 percent of the Bitter Creek Herd Unit, and 9 percent of the Baggs Herd Unit lie within the project area. Only 16 percent of the combined CWR for these Herd Units occurs in the CD-C project area.

If the WGFD were to express formal written concern that any of the herds within the project area was declining at an accelerated rate, all new APDs on leases within mule deer and pronghorn antelope CWR in the CD-C project area would require an approved mitigation plan if the population decrease in those Herd Units were attributable in whole or in part to oil and gas development. The plan would include, but not be limited to:

- Evaluation of reclamation success in the lease and review, approve and oversee the implementation of an Operators' revised reclamation plan to ensure it addresses the reason for the failed reclamation.
- Implementation of BLM-approved habitat-improvement projects such as water developments or vegetation treatments. (BLM may coordinate habitat improvement projects among multiple Operators.) New well pads would not be authorized without Operator participation in habitat-improvement projects in the affected Herd Unit.
- Limitation of the number of well pads to no more than four per section within CWR to maintain habitat effectiveness.

If the population status of a species were to change in the future, additional data would be collected and additional protective measures would be developed.

2.2.3.2 Greater Sage-Grouse

Area of Concern: Greater sage-grouse lek, nesting/brood-rearing habitat (**Map 3.9-2**), and winter concentration areas occur throughout the project area. Protections for the small parts of the project area that are within sage-grouse core areas (Map 3.9-2), for which IM WY-2012-019 (February 10, 2012) prescribes more stringent protections, are described separately. In addition, the BLM has entered into an effort to revise all RMPs to address sage-grouse conservation efforts. As this process unfolds and the RFO RMP amendment is finalized, the requirements for sage-grouse conservation in the RFO may change from the current condition. The Wyoming Core Area strategy (SWED 2011) applies to all activities, proposed in a designated core area, that require a permit from any State of Wyoming regulatory agency. The Wyoming conservation strategy for greater sage-grouse continues to evolve and the requirements that would be applied to proposed activities in all seasonal sage-grouse habitats will change as the strategy changes.

Basic Protections:

- RMP Requirements:
  - Surface-disturbing activities or occupancy are prohibited on and within 0.25 mile of the perimeter of an occupied (or undetermined) greater sage-grouse lek. In addition, disruptive activities are prohibited between 6:00 p.m. and 9:00 a.m. from March 1 to May 20 on and within 0.25 mile of the perimeter of an occupied greater sage-grouse lek. (Disruptive activities are those that would require people and/or the activity to be in nesting habitats for a duration of 1 hour or more during a 24-hour period.[IM WY-2010-029])
  - Avoid surface-disturbing and/or disruptive activities in all identified nesting and early brood-rearing habitat from March 1 to July 15.
  - Authorization of high-profile structures would be granted on a case-by-case basis from within 0.25 to 1 mile of the perimeter of an occupied sage-grouse lek.

  - Surface disturbing and other activities potentially disruptive to delineated greater sage-grouse winter concentration areas are prohibited during the period of November 15 to March 14.

- IM WY-2012-019 Requirements summarized:
  - West Nile Virus - Artificial water impoundments would be managed to the extent of BLM's authority to prevent the spread of West Nile virus where the virus poses a threat to sage-grouse. (See specific provisions in the IM.)
  - Timing and Distance Restrictions **Within Core Areas**
    - Surface occupancy and/or disruptive activities are prohibited on or within 0.6 mile of the perimeter of occupied sage-grouse leks.
    - Surface-disturbing and/or disruptive activities are prohibited or restricted from March 15 to June 30[4] within all suitable sage-grouse nesting and early brood-rearing habitat.
    - Surface-disturbing and/or disruptive activities in delineated sage-grouse winter concentration areas are prohibited from December 1 to March 14 to protect core populations of sage-grouse that use these winter concentration habitats. Not all these WCAs that support core area populations, are located within current core area boundaries.
  - Timing and Distance Restrictions **Outside Core Areas**
    - Surface occupancy and/or disruptive activities are prohibited on or within a 0.25 mile radius of the perimeter of occupied sage-grouse leks.
  - Density and Disturbance **Within Core Areas**
    - For authorization of new proposed actions within sage-grouse core areas, including where there are valid existing rights, the BLM will consider an alternative that would limit activities to an average of no more than one oil and gas or mining location per 640 acres and an average of no more than 5 percent habitat disturbance (related to all programs or applicable sources of "disturbance" using the SGEO [Greater Sage-grouse Core Area Protection Program] Disturbance Density Calculation Tool). In addition, the BLM has entered into an effort to revise all RMPs to address sage-grouse conservation efforts. As this process unfolds and the RFO RMP amendment is finalized, the requirements for sage-grouse conservation in the RFO will change from the current condition.
- Noise – The BLM will work with Operators to limit noise where it could reduce functionality of habitats that support core area populations. The BLM will evaluate limitation of new noise sources on a case-by-case basis. The BLM's near-term goal is to limit noise sources that would negatively impact core area sage-grouse populations and to support the establishment of ambient baseline noise levels for occupied core area leks.
- Standard site-specific requirements – Appendix 15 of the RMP includes other BMPs that can be considered to reduce impacts from gas development, some of which are included as requirements in this alternative, e.g., remote well monitoring.

Enhanced Resource Protections:

Applications for Permit to Drill (APDs) within greater sage-grouse lek, nesting/brood-rearing habitat, and winter concentration areas would be submitted as part of an overall development plan for an entire lease or several leases. The plan is described previously in the general requirements portion of the alternative.

In addition, the following requirements would be implemented throughout sage-grouse habitat:

[4] IM WY-2012-019 allows for the Governor's Executive Order Timing Restriction (March 15-June 30) to be expanded by up to 14 days prior to or subsequent to these dates where credible data support different timeframes.

- Burying new power lines and using low-profile facilities within 1 mile of an occupied lek or in winter concentration areas;
- Use of noise-reduction technology so that noise would not exceed 49 decibels measured at 30 feet from the source at all drilling, production and compressor sites;
- No more than one oil and gas or mining location per 640 acres and no more than 5 percent habitat disturbance (related to all programs or applicable sources of disturbance).
- Surface Disturbance Thresholds:

The BLM has authority to apply a number of protective measures to minimize impacts upon sage-grouse and their habitat. This surface disturbance threshold requires that certain of those measures go into effect on a lease if surface disturbance for natural gas roads, pipelines, well pads or other facilities has exceeded 5 percent of **non-core** sage-grouse lek, nesting/early brood-rearing habitat, or winter concentration areas in a lease or right-of-way or one oil and gas or mining location per 640 acres within **core areas**, the BLM would:

- Require remote well-monitoring at all well pads;
- Evaluate reclamation success in the section and request from the Operator a revised reclamation plan to address any failed reclamation. The calculated percentage disturbance would be adjusted downward for successful interim reclamation.
- Conduct an assessment of the disturbance and determine if enhancement of sage-grouse habitat is needed at that time. If so, begin implementation.

If surface disturbance were to reach 10 percent or 2 oil and gas or mining locations per 640 acres of **non-core** sage-grouse lek, nesting/early brood-rearing habitat, or winter concentration areas in a lease, habitat improvement projects would be required. Projects could include, but would not be limited to:

- Vegetation treatments such as fertilization, seeding, prescribed burning, cutting/chopping for regeneration, planting shrubs, establishment of food plots, etc.
- Water developments.

Population Thresholds:

If WGFD were to express formal written concern that the population of sage-grouse is declining at an accelerated rate, all Operators on public lands within sage-grouse lek, nesting/early brood-rearing habitat or winter concentration areas would implement a mitigation package identified by BLM that would include, but not be limited to:

- Evaluation of reclamation success in the lease or right-of-way and a request to the Operator to provide a revised reclamation plan to address any failed reclamation.
- Vegetation treatments such as fertilization, seeding, prescribed burning, cutting/chopping for regeneration, planting shrubs, establishment of food plots, etc. (BLM may also coordinate habitat improvement projects among multiple Operators.)
- Timing and Distance Restrictions (Non-core areas to conform with core areas):
- When the threshold is reached, surface-disturbing activity or surface occupancy would be prohibited or restricted on or within a 0.6 mile of the perimeter of occupied sage-grouse leks. In addition, disruptive activities within 0.6 mile of the perimeter of occupied sage-grouse leks are restricted from 6:00 pm to 9:00 am from March 1 – May 15.
- Avoid surface-disturbing and disruptive activities in suitable greater sage-grouse nesting and early brood-rearing habitat within 2.5 miles of the perimeter of an occupied lek from March 15 – June 30.
- Prohibition of surface-disturbing and disruptive activities within 0.5 mile of sage-grouse winter concentration areas (non-core areas) from November 15 – March 14.

Density Restrictions:

- Core Area APDs would be limited to the density disturbance calculation tool thresholds (see density restrictions in IM 2012-019). When thresholds are exceeded BLM would work to collocate or minimize disturbance for valid and existing rights.
- When the population threshold is reached in non-core areas, strive to maintain <3 pads per square mile within 2 miles of the perimeter of occupied sage-grouse leks
- If the population status of the species changes in the future, additional data would be collected and additional protection measures would be developed.

2.2.3.3 Ferruginous Hawks

Area of Concern: Nests and potential nesting substrate **(Map 3.8-8**)

Basic Protections:

- RMP Requirements:
  - No disturbance within 1,200 feet of a ferruginous hawk nest. The distances could vary depending on factors such as nest activity, species, natural topographic barriers and line-of-sight distances.
  - Seasonal restriction from March 1 – July 31 within 1 mile of a ferruginous hawk nest.
- Standard site-specific requirements:
  - Surveys of previous active ferruginous hawk nests to determine if they are in use that season. Lack of occupancy by a certain date could shorten the seasonal restriction.
  - If drilling activity within the seasonal distance restriction were started prior to the nesting period and a ferruginous hawk started utilizing a nest, additional mitigation as determined by the BLM could be required. This mitigation could include, but would not be limited to:
    - education sessions for employees regarding avoidance of the nest;
    - reducing speeds and being aware of foraging raptors;
    - utilization of alternate access routes to the well that are further away from the nest, etc.

Enhanced Resource Alternative Protections:

No additional protections would apply to ferruginous hawk nests and potential nesting substrate unless one of the thresholds described below were reached.

Surface Disturbance Threshold:

Operators in all leases that exceed 10 percent of surface disturbance within 1 mile of ferruginous hawk nests would be required to participate in a development/mitigation plan before additional APDs would be issued.

Population Thresholds:

If WGFD were to express formal written concern about the ferruginous hawk population, the following mitigation measures would be implemented immediately:

1. All existing development features and facilities (pads, pipelines, roads, holding yards, compressor stations, etc.) within 1 mile of ferruginous hawk nests would be inspected to determine reclamation success. If reclamation has been unsuccessful, measures would be taken to improve the reclamation of the facilities.

2. Ten man-made[5] nests would be built outside of existing monitoring territories on natural substrates, and farther than 1,200 feet from existing disturbances, prior to January 10th of the year following receipt of WGFD's letter of concern.
    a. The farther the nest is constructed from existing disturbances the better; nest placement would take into consideration potential conflicts with sage-grouse seasonal habitat use of the area.
    b. These nests would be incorporated into the annual monitoring efforts.
    c. Controlled Surface Use and Timing Limitation stipulations would be applied to any nests that become occupied by raptors.
3. Two artificial nesting structures [6] would be placed outside of existing monitoring territories, and farther than 1,200 feet from existing disturbances, prior to January 10th of the year following. receipt of WGFD's letter of concern.
    a. Priority for placement of these nests would be determined based on information regarding extant nests located on man-made infrastructure, or where there are known repeated attempts at nesting on man-made infrastructure; nest placement would take into consideration potential conflicts with sage-grouse seasonal habitat use of the area.
    b. These nests would be incorporated into the annual monitoring efforts.
    c. Controlled Surface Use and Timing Limitation stipulations would be applied to any nests that become occupied by raptors.

If the species population continues to decline, additional data would be collected and additional protection measures would be developed.

2.2.3.4 Muddy Creek and Bitter Creek Corridors/Watersheds

Area of Concern: Muddy Creek (including the Red Wash/Muddy Creek Sensitive Fish Habitat), and the Muddy Creek and Bitter Creek watersheds for water quality (salinity, selenium, and 303d listed waters), aquatic physical habitats, and sensitive fish habitat (**Map 3.9-5**).

Basic Protections:

- RMP Requirements:
    - For protection of amphibians and their habitats, avoidance of surface-disturbing and disruptive activities within 500 feet of perennial waters, springs, wells and wetlands, and areas within 100 feet of the inner gorge of ephemeral channels.
    - Design of road crossings of water bodies that potentially support fish for a portion of the year to simulate natural stream processes.
    - Design of impoundments and instream structures to minimize impacts on Special Status fish species and their habitats.
    - Intensive management of surface-disturbing activities within those portions of the Muddy Creek drainage that contribute to degradation of reaches previously or currently on the 303d list.
    - All basic watershed protections in Section 2.3.16, Water Quality, Watershed, and Soils Management, and Appendix 13, Reducing Nonpoint Source Pollution with Best Management Practices, of the RMP ROD.
- Standard site-specific requirements:

[5] Man-made nests are nests that are built in appropriate habitat and are intended to attract ferruginous hawks.

[6] Artificial nesting structures are built to attract hawks that would build their own nest on the structure.

- Maintenance of existing roads to ensure they are not contributing sediment to Muddy Creek or adjacent wetlands.
- Boring of all pipeline crossings of riparian areas.
- Appendices 13 and 15 of the RMP include several BMPs that can be considered to reduce impacts from gas development, a number of which are included as requirements in this alternative.

Enhanced Resource Alternative Protections:

- For protection of amphibians and their habitats, avoidance of surface-disturbing and disruptive activities within 0.25 mile of Red Wash, springs, wells, and wetlands. The required avoidance distance would be further increased on perennial streams to 0.5 mile. Exceptions would only be granted by the BLM based on environmental analysis and site-specific engineering and mitigation plans. Only actions within areas that could not be avoided and that would provide protection for the resource identified would be approved. In-channel activities would be restricted to the low-flow period.
- Current monitoring on upper Muddy Creek would be extended to Lower Muddy Creek in the CD-C area. This requirement would bring lower Muddy Creek into conformance with the monitoring being done for upper Muddy Creek and other drainages within the Atlantic Rim project area. If results of the monitoring program showed impacts to sensitive fish habitat, the BLM and an interagency CD-C consultation group would determine whether habitat-improvement projects should be implemented. The projects could include, but would not be limited to: increasing the number of drainage features along roads, increasing in-stream cover for fish, etc.
- A monitoring plan for Bitter Creek watershed will be designed by the RFO.
- A risk level analysis will be conducted for the Muddy Creek and Bitter Creek watersheds using the existing Rosgen 2008 WARSS process and data to determine the risk of additional sedimentation. This will permit identification of areas of high erosion potential.

The following requirements related to **selenium and salinity** for well locations and operations would also be implemented:

- No surface discharge of produced waters within the Muddy Creek and Bitter Creek watersheds.
- Line all reserve pits in the Muddy Creek and Bitter Creek watersheds with BLM-approved materials.

2.2.3.5 Chain Lakes Alkaline Wetland Communities and Other Playas

Area of Concern: Chain Lakes Alkaline Wetlands and other playas

Basic Protections:

- RMP Requirements – For protection of amphibians and their habitats, avoidance of surface-disturbing and disruptive activities within 500 feet of perennial waters, springs, wells, and wetlands (defined here as 500 feet from the ordinary high water mark of the playa).
- Standard site-specific requirements – None

Enhanced Resource Alternative Protections:

- A transportation and development plan to avoid the alkaline wetland communities at Chain Lakes.
- Avoidance of surface-disturbing and disruptive activities within 0.25 mile of any Chain Lakes alkaline wetland community or the ordinary high water mark of other playas.

2.2.3.6 Livestock Grazing

Area of Concern: Public land grazing allotments (**Map 3.18-1**)

Basic Protections:

- RMP Requirements – Wyoming Standards and Guidelines for Rangeland Health.
- Standard site-specific requirements – Immediate repair of any damages to existing range improvements, fences, cattleguards, gates, etc. caused by natural-gas operations, with such repairs to be made by the natural-gas Operators in consultation with the grazing permittee.

Enhanced Resource Alternative Protections:

- Mitigation of impacts on existing livestock water features such that there would be no adverse effects on water availability, water quality, or livestock management (trailing routes, fencing, etc.); mitigation of impacts on water wells, springs, or surface water improvements by new water well development. If water features are adversely affected by activities of natural gas Operators, the Operators would be responsible for drilling, maintaining, and monitoring new stock water wells and/or improving existing water wells, as determined by BLM and the grazing permittees.
- Annual meetings conducted by BLM with Operators and grazing permittees to discuss project-specific impacts and required mitigation. Natural gas Operators will describe their proposed drilling and maintenance schedules during these meetings.
- When APDs are submitted to BLM, notification of the affected grazing permittees and provision to permittees of a map showing the location of new well pads and access roads.
- Thorough power-washing by Operators of all field vehicles—particularly their undercarriages—before entering the project area or when moving from one part of the project area to another.
- During the production phase, as well as the construction phase, control by Operators of fugitive dust on well sites, pipelines, and access roads as needed.

Surface Disturbance Thresholds:

If the surface disturbance due to natural gas development were to reach 5 percent of an allotment, several actions would be triggered (in this and later calculations, surface disturbance is used as a surrogate for available forage):

- A review of reclamation success in the allotment. If reclamation efforts had not achieved the required standards, Operators would be required to submit a revised reclamation plan for achieving reclamation success and begin implementing that plan.
- Planning for future natural gas development to avoid critical grazing areas (i.e. calving grounds, trailing routes, and identified summer and winter grounds), range improvements, and other important livestock areas.
- If planning were to identify the need for rangeland improvement projects, BLM would begin planning such projects in consultation with the grazing permittee and the Operators, and may begin implementing the projects, as warranted. Rangeland improvement projects with allotment-wide benefits could involve participation of all Operators within the allotment.

If the amount of unreclaimed surface disturbance due to natural gas development were to reach 8 percent of an allotment, the BLM would require that mitigation be implemented to avoid reaching the designated RMP significance criterion of a permanent 10-percent reduction in AUMs available for livestock grazing within the allotment. The type of mitigation would be determined by the BLM in concert with the grazing permittee and could include, but would not be limited to, the following:

- Construction of temporary fencing when necessary in order to protect reseeded areas and other fragile areas.

- Construction of temporary or permanent fences to create pastures to improve livestock distribution and/or minimize livestock and vehicle collisions (all fences would comply with BLM fence construction regulations).
- Water development projects to distribute livestock, when consistent with the RMP.
- Vegetation treatment projects to increase and improve forage for livestock.

2.2.4 Alternative C: Surface Disturbance Cap—High and Low Density Development Areas

This alternative designates parts of the project area as high-density development areas—those areas that have seen the greatest natural gas development to date (**Map 2-1**). Within the high-density development areas, a 60-acre cap would be placed on the amount of unreclaimed surface disturbance at any one time in a section of public land or federal mineral estate. For the remainder of the project area—the low-density development areas—the cap would be 30 acres per section. The 60-acre cap represents the disturbance associated with a 9-well per section drilling program (80-acre spacing) achieved with vertical wells only, a typical development in the high-density area; a 30-acre cap represents the disturbance associated with a 16-well per section drilling program (40-acre spacing) achieved with directional drilling.

All prior surface disturbance committed to long-term use for roads or on-pad production facilities and all disturbance that had not been successfully reclaimed would count against the cap. Acreage that had successfully undergone interim reclamation would not count against the cap. For example, within a high-density development area, a section that had seen 40 acres of historical disturbance for natural gas development would start the development period with a reduced cap of 20 acres (60 acres less 40). Once interim reclamation on the development was determined to be successful, the acreage reclaimed could be *rolled over*, meaning counted again as undisturbed acreage, and the cap would be increased by the amount of successful interim reclamation. If, for example, 24 acres of interim reclamation were judged to meet the interim reclamation standard, it would be *rolled over* and the cap for that section would increase to 44 acres (20 acres plus 24). Only the 16 acres used for roads and production facilities would continue to count against the cap.

If there had been no natural gas development in a section within the high-density development area, the Operator would be able to develop the natural gas resources of that section until surface disturbance from well pad, access road, and pipeline construction reached 60 acres. At that point, no further disturbance could take place until acreage that had undergone interim reclamation had been determined to be successfully reclaimed. Outside the high-density development areas, the same conditions and the same process would apply, but the cap would be set at 30 acres.

Map 2-1 shows the high-density development and low-density development areas within the project area. Of the 1,697 sections within the project area, 744 sections (about 44 percent) are within a high-density development area. Average historic surface disturbance within the high-density development areas is 32.9 acres per section. The average number of wells per section is 5.1. Outside the high-density development areas, the average disturbance is 4.5 acres per section; the average number of wells per section is 0.7. Four hundred sections, about 24 percent, have had no development to date.

All public lands in the project area would be subject to the cap. Disturbance on private and state lands would not count against the cap. The Operators would be required to update their reported disturbance annually in order to certify the accumulated disturbance on their federal lease holdings to date and the amount of interim reclamation that had occurred. Under the alternative, the BLM, either on its own or using subcontractors hired by the Operators, would perform quality control on the reported data and evaluate the reported interim reclamation and the success of that reclamation. The BLM would then calculate net available surface disturbance under the cap for each section. As new drilling proposals were received, they would be evaluated against the net available surface disturbance within the section where

the drilling was proposed. For oil and gas leases smaller than a section, the acreage cap would be adjusted on a pro-rata basis.

All pre-existing and current surface disturbance associated with natural gas well pads, their access roads, and gathering pipelines would count against the cap. Major natural gas processing and transmission facilities would not count against the cap. In addition, federal, state, county, and local roads and highways, railroads, and disturbances created by ranching operations would not count against the cap.

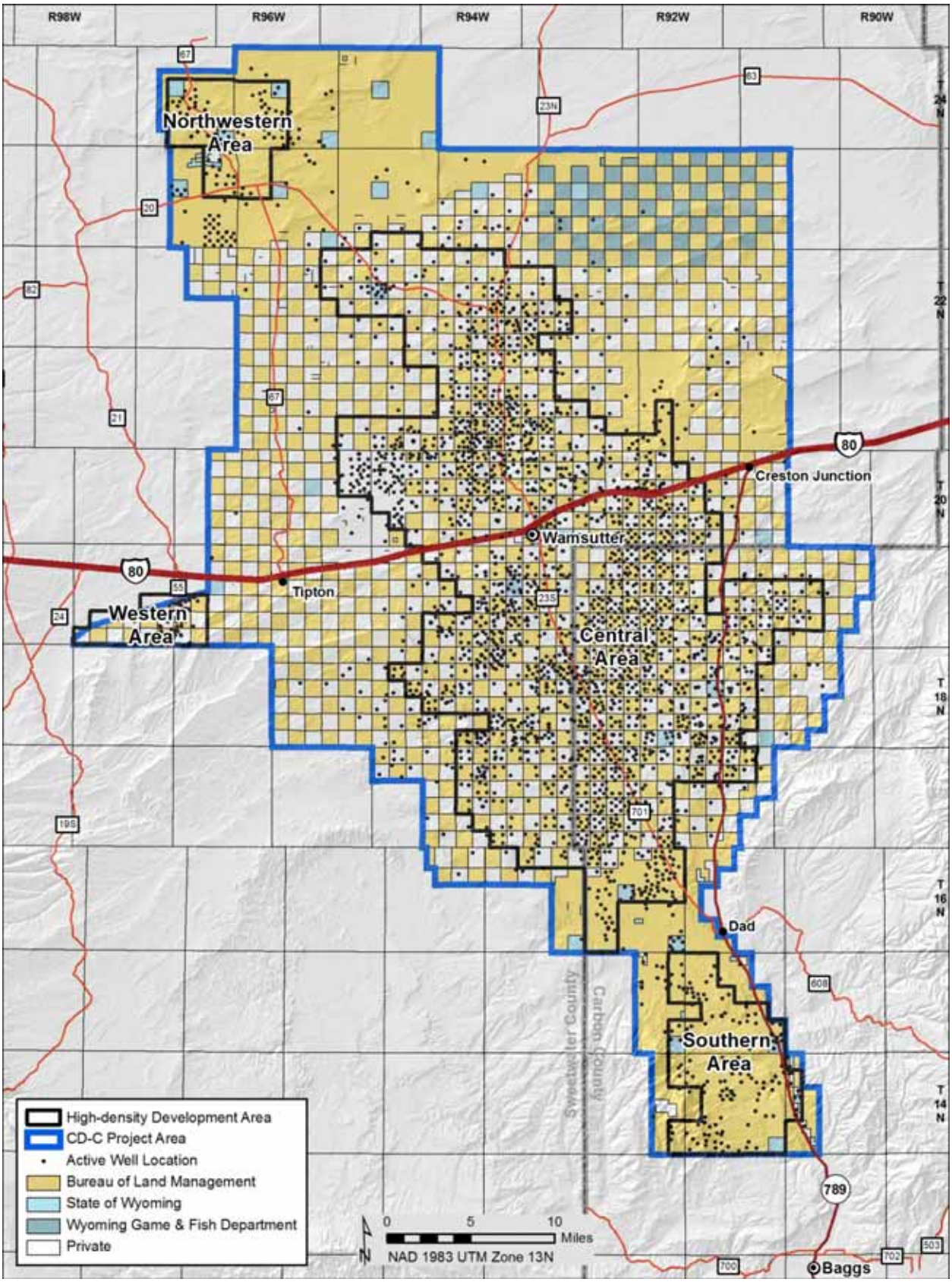
A central element of this alternative is the standard used to determine if interim reclamation efforts have been successful and if the reclaimed acreage can be rolled over. The standards to be met for successful final reclamation of surface disturbance on public lands are described in **Appendix E: Reclamation**, which includes Appendix 36 of the Rawlins RMP (BLM 2008b) and the Wyoming BLM Reclamation Policy IM WY-2012-032. Final reclamation of a natural gas well site occurs after a well has completed production and been plugged and abandoned. **Appendix E** also includes two other documents that apply to interim reclamation and the concept of rollover: the Proposed Interim Rollover Objective for the CD-C Natural Gas Project and the CD-C Rollover Criteria. These two documents would guide the evaluation of reclamation under the Alternative C surface cap and set the standard for potential rollover of acreage that had undergone interim reclamation. The Rollover Objective document provides guidance for how best to achieve interim reclamation that can be rolled over. The CD-C Rollover Criteria document lays out the standard that must be met if disturbed acreage is to be classified as successful interim reclamation. Disturbed acreage that met the standards could then be deducted from the number of acres counted as surface disturbance—that is, rolled over.

During the preparation of the Draft EIS, the State of Wyoming, local Conservation Districts, the University of Wyoming, participating leaseholders, several CD-C operators, and the BLM developed interim reclamation objectives (IRO). The purpose of the IRO is to identify when reconstruction and re-vegetation activities on disturbed lands are adequate for rollover credit. The objectives are to: establish vegetation cover sufficient to maintain a healthy, biologically active topsoil; control erosion; minimize loss of habitat, forage, and visual resources during the period of the disturbance; and control invasive non-native weeds. The specific reclamation success standards for the IRO are as follows:

- The area is revegetated with a stable, approved plant community.
- Vegetative cover is sufficient to maintain a healthy, biologically active topsoil.
- Erosion is controlled.
- Habitat, visual, and forage loss is minimized.
- No noxious weeds are present.

Reclamation of the disturbed surface would be monitored by the Operators. When an operator determined that a disturbed site had attained the IRO, the operator would propose to the BLM the rollover of the reclaimed acreage. If the BLM determined that the standards had been met, the acreage would be rolled over. If the BLM determined that the standard had not been met, then the operator could attempt to address the shortcomings of the reclamation and propose the acreage again at some time in the future. In the event areas that had met the criteria and been rolled over were re-disturbed, the acreage re-disturbed would again be counted against the cap.

Table 2.4-1 shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.



Map 2-1. High-density and low-density natural gas development areas, CD-C project area

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

2.2.5 Alternative D: Directional Drilling

This alternative requires that all future natural gas wells on federal mineral estate be drilled from multi-well pads, which would require the employment of directional drilling technology. One new multi-well pad per section (or per lease if the lease area is less than a section) would be permitted. In sections that have already had oil and gas development, the enlargement of one existing well pad would be permitted as the multi-well pad for all future drilling in that section. No new roads or pipeline routes on a lease would be permitted. Proposals for access across federal lands for oil and gas development on adjacent private and state parcels would still be considered as appropriate by the BLM.

In sections that have not had oil and gas development at all, one new well pad would be permitted for all future development. One road and pipeline corridor per well would be permitted. Proposals for access across federal lands for oil and gas development on adjacent private and state parcels would still be considered as appropriate by the BLM. No numerical disturbance caps, no rollover credits, and no new requirements on reclamation are part of this alternative.

The objective of this alternative is to minimize surface disturbance and to reduce habitat loss and wildlife disruption. A reduction in the number of well pads and associated roads, pipelines, and other facilities would result in less surface disturbance and thus reduce the amount of habitat directly lost. In addition, multiple-well pads would be distributed less densely than single-well pads, reducing the habitat fragmentation and ongoing disturbance created by the network of well-pad access roads.

Operators may request that an APD be excepted from the general rule. Examples of the types of exceptions that would be considered include:

- In sections that have already had some level of development, Operators may request that more than one existing well pad be used as a multi-well pad. The Operator must establish that the drilling objective cannot be achieved from any single well pad. In general, such requests would be considered by BLM after one single-well pad had been enlarged and efforts had been made to develop the entire section.
- In sections that have not had prior development, Operators may request that more than one multi-well pad be constructed. The Operator must establish that the drilling objective cannot be achieved from a single-well pad. In general, such requests would be considered by BLM after one multi-well pad had been constructed and efforts had been made to develop the entire section.
- Operators may request that road and pipeline routes be relocated. The request should demonstrate how the relocation would reduce vehicle traffic and increase the efficiency of product transportation.

It is expected that exception requests would largely be based on difficult surface conditions, topography, subsurface geology, or fluid mineral resource characteristics that would make it impossible to maximize the recovery of the gas resource in a lease. CBM proposals may well fall into an exception category. Requests based on the need to produce in the most economic and efficient manner will be considered.

Table 2.4-1 shows the estimated surface disturbance for this alternative along with the Proposed Action and the other alternatives.

2.2.6 Alternative E: No Action

NEPA regulations require that the EIS alternatives analysis "include the alternative of no action" (40 Code of Federal Regulations [CFR] 1502.14(d)). The No Action alternative does not respond to the purpose and need for the Proposed Action. Rather, it serves as a baseline for comparing the Proposed Action's environmental effects (including cumulative effects) and it illustrates the consequences of not meeting the need for the Proposed Action. Under the No Action alternative, no new Federal wells would

be approved for development as part of the Operators' proposal to drill up to 8,950 wells on approximately 1.1 million acres of federal, private, and state mineral estate. However, existing lease rights granted by the BLM on federal lands or mineral estate would remain in effect. The BLM's analysis of the No Action alternative therefore assumes that previously authorized activities would continue but that no new development on federal lands or mineral estate would occur under the Operators' proposal. Previously authorized activities include approximately 14 pending APDs, 497 shut-in gas wells, 12 monitor wells, 530 plugged and abandoned wells, 3,292 producing gas wells, and 27 unapproved APDs, totaling 4,372 wells within the CD-C project boundary as of September 2012 (WOGGC 2012). As shown on **Table 4.0-1**, existing surface disturbance related to natural gas development is an estimated 49,218 acres.

Due to the intermingling of federal, state, and private lands within the CD-C, rejection of the Operators' proposal under the No Action alternative would not mean that no new oil and gas development in the project area would occur. Such development may be authorized on state and private lands, as the BLM does not approve or control development on these lands. In addition, the BLM may receive and consider proposals for access across federal lands for oil and gas development and production-related activities. The BLM also may receive and consider additional or supplemental proposals (such as pipelines, compressors, and power lines) to develop leased resources, such as natural gas, on federal lands in the project area. Individual proposals for geophysical exploration or development, including rights-of-way for access across federal lands, would be subject to site-specific analysis prior to approval or authorization by the BLM.

2.3 ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED STUDY

Two alternatives were considered and eliminated from detailed study. The alternatives and the reasons for eliminating them are described below.

2.3.1 Surface Disturbance Cap with Reclamation Credits and Debits

This alternative would place a 30-acre cap on the amount of future surface disturbance in a section of public land. If previous natural gas development had disturbed the surface in a section, the acreage that had been successfully reclaimed would be added to the 30 acres. If the disturbance had not been successfully reclaimed, the acreage would be subtracted from 30 acres. The aim is to provide additional incentive for successful reclamation and increased disincentive for slow or failed reclamation. For example, in a section in which 10 acres of surface disturbance had occurred and 6 acres had been reclaimed, the cap would be modified according to the success or failure of the reclamation on those 6 acres. (The 4 acres used for roads and on-pad facilities would not count one way or the other toward credits or debits, but would count against the cap.) If the 6 acres met the criteria for successful reclamation, the modified cap for that section would be 30 acres plus the 6 acres of reclaimed surface, a total cap of 36 acres (of which 4 had been used for roads and on-pad facilities, leaving 32 acres that could still be utilized). If, on the other hand, the 6 acres did not satisfy the criteria, the modified cap would be 24 acres—the 30-acre base less the 6 acres of unsuccessful reclamation (4 of which were already impacted, leaving 20 acres for future development). If half the reclamation met the criteria and half did not, the 30-acre cap would remain unchanged, as the failed 3 acres would offset the successful 3 acres, leaving the cap at 30 acres with 4 of those acres encumbered.

After closely considering this alternative, the BLM determined its actual operation would be unpredictable and that neither the BLM nor the Operators could rely on its results. In certain instances, the formulation could yield a cap in one section of perhaps 90 acres and in an adjacent section of minus 30 acres. The complexity of the alternative and the uncertainty of its results make it difficult to describe and there is a high likelihood that the result would be contention between the BLM and the Operators over the meaning of and the operation of the cap. Because of the complexity and the uncertainty about its

effects, and because Alternative C already satisfied all the criteria for a surface disturbance cap, the BLM decided that the Surface Disturbance Cap with Reclamation Credits and Debits would not be carried forward for analysis in the EIS.

2.3.2 Focused Development

The Focused Development Alternative would include the same degree of overall natural gas development as the Proposed Action, but the drilling would be phased geographically, focusing first on one defined area and then moving to another area following completion of development in the initial area. The purpose of the geographical phasing would be to allow large areas of wildlife habitat to remain undisturbed for an extended period, during which other areas would undergo intense and continuous development. Several alternatives with this general formulation were considered during discussions between the Operators and the CD-C cooperating agencies between 2005 and 2009. The BLM was not a participant in those discussions. Discussions were aimed at identifying larger tracts of habitat that could remain undeveloped for a considerable period of time and other areas—areas of focused development—that would be completely developed during that same period. In exchange for agreeing to delay developing in one area, the Operators would receive exemption from seasonal wildlife stipulations on public lands in the area of focused development. Upon completion of development in the initial focus area, that area would in turn have no activity and development would shift to the previously undeveloped area.

The concept of focused development has two key elements: (1) that the leaseholders, property owners, Operators, and others with an interest in the production of oil and gas in both the area of focused development and those in the area of delayed development area be the same or at least have a shared interest, since all the parties would have to participate if the concept were to be effective; and (2) that the BLM would be able to exempt the federal oil and gas leaseholders from the seasonal wildlife stipulations. After considerable examination, it was determined that neither of the key elements could be provided.

In the case of developing a shared interest among those interested in developing the fluid mineral estate, the sheer number of interests (over 60 different leaseholders within the project area and over 20 different operators), and the diversity and complexity of their holdings presented legal, planning, and logistical problems that could not be overcome. Additionally, the substantial portion of the project area that is within the checkerboard would require participation by private property owners, many of whom are not federal leaseholders.

The creation of an oil and gas *unit* is one method of creating a shared interest among various parties. A unit agreement allows exploration and development of properties owned by multiple parties to proceed with a program paced to develop all lands within the unit, regardless of ownership boundaries. Unitizing the CD-C project area to create a shared interest would not work because: (1) The leaseholders, property owners, operators, and operating rights owners over such a wide geographical area—the whole project area or a large part of it—do not have sufficient interests in common for a single exploratory unit to be formed; (2) Developing exploration units requires certain levels of obligation to drill wells. Under the *Yates* decision, if the drilling is successful and yields a producing well, all leases covered by the unit are considered *held* by production (Yates Petroleum Corp. *et al.*, 67 IBLA 246, 1982). Holding hundreds of thousands of leasehold acreage without development is not in the best interest of the BLM as the federal lessor; and (3) Leases are offered and granted with certain time terms, during which leaseholders and Operators are obligated to develop the leases or the leases will expire. If a CD-C project unit were to form, then hundreds of thousands of leased acres could be held by production from only a few wells and the owners of these leases likely would not receive the returns needed to pay out the cost of acquiring the leases. This in turn could result in the operator not being able to drill and produce at adequate levels to meet their income requirements or returns on investment. This would be a major impact to stockholder value and the development of U.S. energy.

It was also determined that exempting the leaseholders from seasonal wildlife stipulations could not be done. The BLM reviewed the federal laws and regulations that govern the management of habitat of species protected under the ESA and those that were designated as Special Status by the BLM and concluded it could not agree to the necessary blanket exemptions, over such a large area, for such an extended period of time. With no ability to bring about either of the key elements of the Focused Development alternative, the participants in the discussion concluded that such an alternative could not be properly designed and implemented.

2.4 COMPARISON OF ALTERNATIVES

Table 2.4-1. CD-C project area disturbance: Proposed Action and alternatives (acres)

Category	Well Pads (incl. roads)	Related O&G Facilities	Total Disturbed Area	Change from Proposed Action	
	acres			acres	%
Proposed Action					
Initial	41,889	5,311	47,200	—	—
Long-term	17,998	863	18,861	—	—
Alternative A: 100-Percent Vertical Drilling					
Initial	56,385	5,311	61,696	14,496	30.7%
Long-term	23,270	863	24,133	5,272	28.0%
Alternative B: Enhanced Resource Protection					
Initial	40,205	5,311	45,516	-1,684	-3.6%
Long-term	17,386	863	18,249	-611	-3.2%
Alternative C: Cap on Surface Disturbance, 60 Acres and 30 Acres per Section					
Initial	37,644	5,311	42,955	-4,245	-9.0%
Long-term	16,455	863	17,318	-1,543	-8.2%
Alternative D: Directional Drilling					
Initial	31,138	5,311	36,449	-10,751	-22.8%
Long-term	14,089	863	14,952	-3,908	-20.7%
Alternative E: No Action					
Initial	0	0	0	-47,200	-100.0%
Long-term	0	0	0	-18,861	-100.0%

[1] *The project area is 1,070,086 acres.*

Table 2.4-2. Comparison of impacts by alternative

Feature/Resource	Proposed Action	Alternative A: 100-Percent Vertical Drilling	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action
Physical Environment						
Geology	The intensity of impacts on geologic resources would vary in relation to the surface disturbance by alternative, but would be low in all cases providing that best management practices are followed. Impacts would not be significant.					
Paleontology	Paleontological resources have been identified in over 30 localities within the project area. Implementation of the **Proposed Action** or any of the **action alternatives** may impact paleontological resources—in a negative way by destroying or damaging them and making them unavailable for scientific inquiry—to the extent that the ground is disturbed by development activities, (see **Table ES-1** above). Disturbance could be beneficial by resulting in the discovery and preservation of fossils that add to scientific knowledge. Pre-disturbance surveys and disturbance mitigation where appropriate would minimize adverse impacts. The impact significance criterion would not be exceeded.					
	Intermediate impact	*Most impact*	*Intermediate impact*	*Intermediate impact*	*Lowest impact*	*No impact*
Soils	Impacts would be similar for the **Proposed Action** and all **action alternatives** but the extent would vary with the amount of project-related disturbance, from a high of 61,696 acres under **Alternative A** to a low of 36,449 acres under **Alternative D**. The percentage of the CD-C project area soil surface that would be initially disturbed by the **Proposed Action** and the **action alternatives** is shown below. These figures should be considered in light of the 5.6 percent of the project area soil surface that has been disturbed previously. Successful implementation of mitigation measures and BMPs would insure that significance criteria were not exceeded.					
	4.4 %	*5.8 %*	*4.3 %*	*4.0 %*	*3.4 %*	*0 %*
Water Resources: Surface Water	Under the **Proposed Action** and all **action alternatives**, surface water impacts could include contamination of surface water from the authorized and accidental discharge (spill) of fluids and produced water and the impacts (including sediment loading) from surface disturbance related to the construction of pad sites, roads, and pipelines. The degree of potential impact and the risk of adverse impacts is related directly to the amount of initial surface disturbance in each alternative. Each action alternative exceeds at least one of the 8 significance criteria. The number of criteria exceeded for each alternative is displayed below:					
	4 criteria	*8 criteria*	*1 criterion*	*2 criteria*	*2 criteria*	*No new impacts*
Water Resources: Groundwater	Significant impacts to groundwater are not expected under the **Proposed Action** or the **action alternatives** because the formations targeted for gas development and produced water disposal are stratigraphically isolated from aquifers that host springs and flowing wells used for stock and domestic purposes, because of state-of-the-art construction techniques, and because of implementation of BMPs and COAs related to drilling.					

Table 2.4-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative A: 100-Percent Vertical Drilling	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action
Physical Environment, continued						
Air Quality	Impacts from the **Proposed Action** and all **action alternatives** would not cause an exceedance of any ambient air quality standard and would not exceed the Prevention of Significant Deterioration (PSD) Class II Increments at a 250-meter distance from project sources. However, modeled impacts at a100-meter distance from field development project sources did result in short-term concentrations that were predicted to be above the 1-hour NO_2 National Ambient Air Quality Standard (NAAQS), the 24-hour $PM_{2.5}$ NAAQS, and the 24-hour PM_{10} Wyoming Ambient Air Quality Standard (WAAQS). Impacts would not exceed the PSD Class I or Class II increments at any of the Class I and sensitive Class II areas. The visibility analysis indicated a maximum of 5 days with project emissions resulting in impacts greater than the 0.5 delta deciview (Δdv) threshold at any of the Class I and sensitive Class II areas; using the 98th percentile value as a threshold, there are zero days above the 0.5 Δdv threshold. There would be no nitrogen and sulfur deposition impacts that exceed BLM critical load values at any Class I or sensitive Class II area. In addition there would be no impacts to sensitive lakes that exceed threshold values. All BLM-approved energy development projects will comply with applicable air quality regulations and standards, as determined by the WDEQ.					
Biological Environment						
Vegetation	Vegetation has already been strongly affected; historic disturbance equivalent to 5.6% of the area's surface has already occurred. Additional disturbance would produce combined historic and project-related disturbance for the **Proposed Action** and each **action alternative** equivalent to the surface area percentages shown below. Even with successful implementation of reclamation practices, about 40 percent of the disturbed area would remain in an unvegetated state during the production period for the project—45-55 years. The remaining 60 percent of the disturbed area would have reduced productivity while reclamation is in progress and would have an altered species composition and density for the life of the project and beyond, including a long-term loss of shrubs. Estimated percentage vegetation disturbance by alternative, including the historical 5.6% disturbance, is:					
	10.0%	*11.4%*	*9.9%*	*9.6%*	*9.0%*	*5.6%*
Invasive, Non-Native Species	Initial surface disturbance would create opportunities for invasive species and development activity would increase the degree to which such species spread throughout the project area. The principal difference in impacts for the **Proposed Action** and **each alternative** is related to the amount of surface disturbance that would initially occur for each:					
	Intermediate impact	*Most impact*	*Intermediate impact*	*Intermediate impact*	*Lowest impact*	*No impact*
Terrestrial Wildlife	Impacts would include loss of forage, as well as direct and indirect loss of habitat. The percentage of short-term disturbance of crucial winter range that would be disturbed includes historic plus new. Historic disturbance is 7.3% for pronghorn and 2.4% for mule deer. Significant impact can be reached by actions that result in disruption or irreplaceable loss of vital and high-value habitats such as crucial winter range and migration corridors, resulting in impacts that exceed the *High* or *Extreme* impact definitions. Big game species in the area are expected to be significantly affected by the **Proposed Action** and **Alternatives A, B,** and **C** but not by **Alternative D**.					

Table 2.4-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative A: 100-Percent Vertical Drilling	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action
Biological Environment, continued						
Pronghorn[7]	*High Impact*	*Extreme Impact*	*High Impact*	*High Impact in High Density Area*	*Moderate Impact*	*No New Impact*
Mule Deer[7]	*High Impact*	*Extreme Impact*	*High Impact*	*High Impact in High Density Area*	*Moderate Impact*	*No New Impact*
Aquatic Wildlife	For the **Proposed Action** and all **action alternatives**, impacts to aquatic wildlife are primarily associated with increased sediment entering aquatic habitats from ground-disturbing activities and road building adjacent to or crossing aquatic habitat but significant effects are not expected. Alternative B has additional protections for the Muddy Creek/Bitter Creek watersheds and other aquatic habitats such as the Chain Lakes wetlands and playas.					
	Intermediate impact	*Most impact*	*Intermediate impact*	*Intermediate impact*	*Least impact*	*No new impact*
Special Status Wildlife	Those Special Status wildlife species that have potential impacts from the **Proposed Action** or any of the **action alternatives** approaching or reaching the level of significance are identified below. Sage-grouse within core areas are not expected to be affected to a degree that approaches significance because of the SGEO's application on private and state lands as well as federal lands.					
Sage-grouse (non-core area only)	*Likely to exceed in non-core areas*	*Likely to exceed in non-core areas*	*Not expected to exceed*	*Less likely to exceed than Proposed Action*	*Not expected to exceed*	*No new impact*
Endangered Fish	Impacts to the four Endangered fish found downstream of the project area are not expected to occur under any alternative, except for minor water depletion. A determination on potential water depletions is contingent on consultation with the USFWS.					
Sensitive Fish	Sensitive fish are found primarily in the Muddy Creek drainage; the likelihood of impacts to these species exceeding the significance criteria under the **Proposed Action** and the **action alternatives** is:					
	Will exceed	*Will exceed*	*May exceed if actions on private lands offset public land restrictions*	*Likely to exceed*	*Less likely to exceed*	*No new impact*

[7] The impact levels noted for Pronghorn and Mule Deer are based on WGFD (2010) definitions.

Table 2.4-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative A: 100-Percent Vertical Drilling	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action
Biological Environment, continued						
Special Status Plants	Measures aimed at avoiding and protecting special-status plants that would be implemented under the **Proposed Action** and all **action alternatives** would insure that special-status plants would be little affected directly. To the extent that surface disturbance decreases and the number of disturbance sites is reduced, the likelihood of adverse impact is diminished further.					
Wild Horses	Long-term AUM (animal unit month) loss in Lost Creek and Adobe Town HMAs is estimated at:					
	80 AUMs	*106 AUMs*	*77 AUMs*	*73 AUMs*	*63 AUMs*	*0 AUMs*
Human Environment						
Visual Resources	Under the **Proposed Action** and all **action alternatives**, adequate visual mitigation in the form of BMPs and conditions of approval would allow oil and gas development to be compatible with the management objectives for VRM Class III landscapes in the project area by partially retaining the existing character of the landscape. Development would be compatible per se with VRM Class IV objectives because VRM Class IV is meant to allow for major modification of the existing character of the landscape. There would be no new impacts under **Alternative E, No Action**.					
Recreation	The intensity of impacts to recreation would correlate to the variation in long-term surface disturbance by alternative:					
	Intermediate impact	*Most impact*	*Intermediate impact*	*Intermediate impact*	*Least impact*	*No new impact*
Lands with Wilderness Character (LWC)	Under the **Proposed Action** and **all alternatives**, there would be no impact on LWCs.					
Cultural and Historical Resources	Pre-disturbance surveys and avoidance would minimize adverse impacts and remove the potential for significant impacts for all alternatives; the number of sites that might be identified (and the number potentially eligible for NRHP), are described by alternative:					
	1,888 (434)	*2,467 (568)*	*1,821 (418)*	*1,718 (395)*	*1,455 (362)*	*No new impact*

Table 2.4-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative A: 100-Percent Vertical Drilling	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action
Human Environment, continued						
Socioeconomics	The **Proposed Action** and the **action alternatives** would generate similar effects with minor differences. About 1,600 direct project-related jobs would be created by Year 15 of development. Total project-related employment (direct, indirect, and induced jobs) would climb to a peak of around 4,000 jobs in Year 14, an addition to existing project employment. Employment effects would continue during production after the field is fully developed, but be lower than those during development. Following completion of development and production, regional employment would decrease by over 4,300 jobs, including both new and existing jobs, a net job loss. Population changes would closely follow employment gains and losses, peaking at about 3,700 new residents and almost 1,000 temporary workers during Year 15 of development and falling to about 700 residents by Year 20. Community facilities should be adequate to accommodate the added population but may require expansion during the latter part of the 15-year development cycle. Demand for community facilities would substantially diminish after development is completed. Substantial government revenues would be generated by the natural-gas production—about $3.8 billion in federal royalties, an estimated $530 million in state mineral royalties, and $3.1 billion in ad valorem and gross products taxes. Project-related employment, population, and revenue generation effects would not occur under **Alternative E, No Action**.					
Transportation	Development-related estimated peak annual average daily traffic (AADT) by alternative is as follows (estimated long-term production-related AADT is the same for all alternatives, 1,360):					
	> 3,900	*>4,217*	*Reduced from PA 1-2%*	*Reduced from PA 3-4%*	*Reduced from PA 3-11%*	*0*
Noise	The **Proposed Action** and **Alternatives** would generate similar types of noise from construction and operations, including traffic-related noise. The volume of noise would be directly related to the number of well pads for each alternative, as follows:					
	6,126	*8,950*	*5,798*	*5,299*	*4,032*	*0*
Management Environment						
Range Resources	Estimated long-term forage loss (AUM equivalent) and number of allotments at risk of exceeding significance criteria (10% decrease in AUMs), by alternative, are as follows:					
	*1,985 AUMs (**four** allotments at risk)*	*2,540 AUMs (**more** allotments at risk than PA)*	*1,921AUMs (**fewer** allotments at risk than PA)*	*1,832 AUMs (**fewer** allotments at risk than PA)*	*1,574 AUMs (**fewer** allotments at risk than PA)*	*No new impact*

Table 2.4-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative A: 100-Percent Vertical Drilling	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action
Management Environment, continued						
Oil and Gas and Other Minerals	Under the **Proposed Action** and all **action alternatives**, the natural gas resources of the project area would be developed fully. Natural gas reserves produced over the life of the project are estimated at 12.02 trillion cubic feet. Under **Alternative E**, the Operators would still possess lease development rights but it is assumed that fluid mineral resources would not be developed under this proposal.					
Health and Safety	The **Proposed Action** and all **action alternatives** would result in similar impacts to the public and site workers, including increased risk of vehicle collisions on interstate highways and local road systems.					
Waste and Hazardous Materials	Currently authorized and approved actions are already exerting stress on the permitted and authorized disposal facilities proximal to the project area. Authorization of the **Proposed Action** or **Alternatives A through C** would result in further stress to the capacity of permitted waste management units used by the operating companies, including those used for management of solid waste, produced water, and drilling mud. **Alternative D** may serve to extend the life of some existing disposal facilities.					